Biomass
An Introduction

Biomass represents an entire category of energy resources made from living material. Many of these resources — such as agricultural crops, wood, animal by-products, residues, and wastes — are plentiful in Iowa. An abundance of raw material and a wealth of agricultural knowledge position Iowa to become a world leader in the development of biomass as a renewable energy resource.

According to a study completed by the Oak ridge National Laboratory[1], Iowa has a total biomass potential of 32,785,000 dry tons per year. This total consists of:

- Urban and mill residues, including chips and grindings of non-hazardous wood from construction activities, discarded waste pallets and crates, woody yard trimmings, sawdust, bark, and wood scraps from paper lumber and furniture manufacturing.
- Forest residues, including under-used logging residues, imperfect commercial trees, and deadwoods.
- Agricultural residues, including residues remaining after harvesting agriculture crops, wheat straw, and corn stover.
- Energy crops, including crops developed and specifically grown for fuel such as fast growing trees, shrubs, and switchgrass.

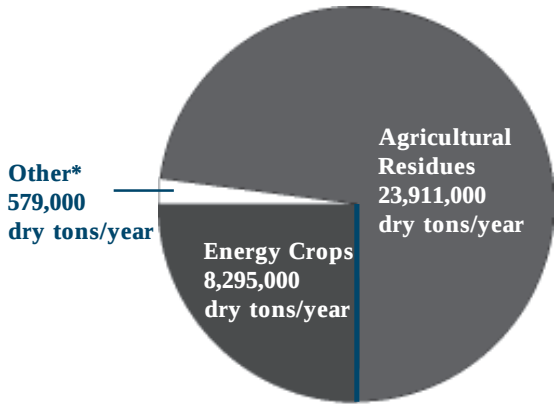
The U.S. DOE Energy Efficiency and Renewable Energy Network states that Iowa's biomass potential translates to 47.7 billion kWh of electricity that could be generated to supply more than 4 million homes annually or 410 percent of Iowa residential electricity use.[2]

Historically, biomass has been unable to compete with coal, petroleum-derived products, or natural gas in terms of price. Increasingly, however, private businesses, government, and the public are re-evaluating the advantages of biomass, which include:[2]

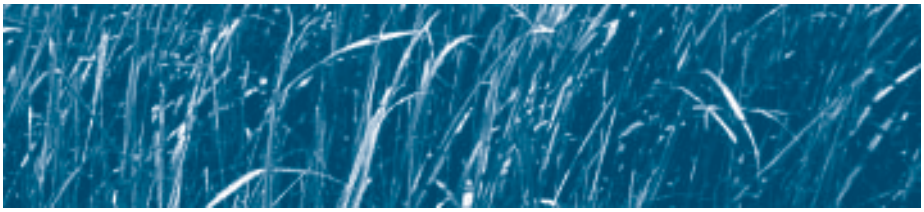
- Biomass can be converted to fuels and chemicals, supplementing or replacing fossil fuel-derived products.
- Biomass is a portable form of renewable energy. Like a battery, biomass stores energy to be used in another time or place.
- Biomass energy represents an important cash crop opportunity for farmers. Developing the energy source can result in new agricultural and technological markets, stimulating local economic development and job creation.
- Biomass energy emits fewer pollutants than fossil fuels.
- Biomass in the form of energy crops absorbs carbon dioxide (CO_2), a greenhouse gas, as it grows. When biomass is burned, it releases no more CO_2 than it originally absorbed, resulting in no net increase in CO_2 emitted into the atmosphere.

In addition, biomass has strong potential for niche markets in Iowa. According to an Iowa State University study, the following may serve as

Iowa's Energy Potential: Available Biomass Resources



*Other = Mill, Forest and Urban Residues.
Source: Biomass Feedstock Availability in the United States, 1999. Oak Ridge National Laboratory.



Consider this...

If 5 percent of Iowa's energy portfolio consisted of biomass, the following cumulative results would be achieved for 1997-2015:[4]

- $280 million in disposable income
- 27 million tons of CO_2 emissions avoided
- 90,000 tons of NOx emissions avoided
- 1.02 million tons of SOx emissions avoided
- 118,000 tons of particulate avoided

cost-competitive energy applications for biomass resources:[3]

- baled corn stover for boiler fuel
- municipal yard waste converted into heat or power
- unused seed corn to fire cement kilns
- crop residues, corncobs and unused seed corn in grain-drying operations
- switchgrass for use as reburning fuel in coal-fired cyclone burners to reduce nitrogen oxide emissions
- manure converted to methane through anaerobic digestion for on-farm use
- landfill and wastewater methane converted to electricity

Iowa's biomass stakeholders are collaborating to develop and promote promising biomass resources in the state. The following sections in this *Renewable Energy Resource Guide* address key developments in Iowa's emerging biomass initiatives — particularly those related to renewable transportation fuels, methane recovery and energy crops.

The New BioEconomy

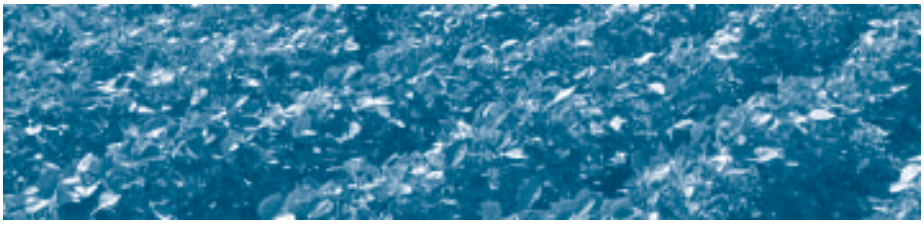
A new focus for Iowa is establishing a "BioEconomy," in which Iowa's agricultural base is positioned to lead a new era of industry that is developing bio-based products and bio-energy.

Bio-based products are made from renewable materials grown in farm fields, coastal waters and managed forests. These resources can replace petroleum-based materials used in industrial and commercial products. Examples include lubricants, plastics or adhesives made from soybeans, and building products made from cornstalks. It also includes renewable energy resources.

The Center for Industrial and Research Services (CIRAS) at Iowa State University is leading a program called "Industries of the Future: Agriculture" to create a vision and a roadmap for a BioEconomy in Iowa. The Iowa DNR, the Iowa Energy Center, ISU Extension, and several other state agencies, universities, private industries and agricultural groups are collaborating on the program. For complete information, go to: **www.ciras.iastate.edu**

References

1. Marie E. Walsh, et al. *Biomass Feedstock Availablity in the United States: 1999 State Level Analysis.* Oak Ridge National Laboratory, Oak Ridge, TN. April 30, 1999. Updated January 2000.
2. Energy Efficiency and Renewable Energy Network. Iowa Bioenergy Resources. Sept. 2002. www.eren.doe.gov/state_energy/tech_biomass.cfm?state=IA
3. Brown, Robert C. *The Potential for Biomass Production and Conversion in Iowa: An Executive Summary to the Iowa Energy Center.* August 31, 1994. p. 19-20.
4. *1998 Energy Plan Update: Iowa's Progress to an Energy Wise Future*. Iowa Department of Natural Resources. January 1998. p. 17.
5. *Biomass Energy CONversion Facility: Fuels and Chemicals from Biomass*, Iowa Energy Center.



Iowa
Energy Center's BECON Facility

The Iowa Energy Center created the Biomass Energy Conversion facility (BECON), located in Nevada, Iowa, to bridge the gap between laboratory research and commercial applications. BECON is designed to become a focal point for the development of biomass products and technologies as well as pilot-scale demonstrations in the following areas:[5]

- **thermal gasification** — the process of transforming solid biomass into gas through partial combustion
- **pyrolysis** — the process of transforming solid biomass into a liquid similar to crude oil through thermal processing
- **anaerobic digestion** — the controlled decomposition of biomass in the absence of oxygen
- **fermentation** — the process of converting organic material from one form to another using micro-organisms
- **biodiesel** — a non-toxic alternative to diesel fuel with reduced air emissions

BECON also provides a venue for exploring the integration of various biomass technologies and conversion systems.

Research at the BECON facility is conducted by Iowa's educational institutions, private non-profit organizations and their research partners. In addition, businesses and the public are invited to attend demonstrations, field days and training sessions held periodically at the site.

Consider this...

- Biomass is our most abundant source of solar energy.